

Volumetric 3-Component Velocimetry (V3V)



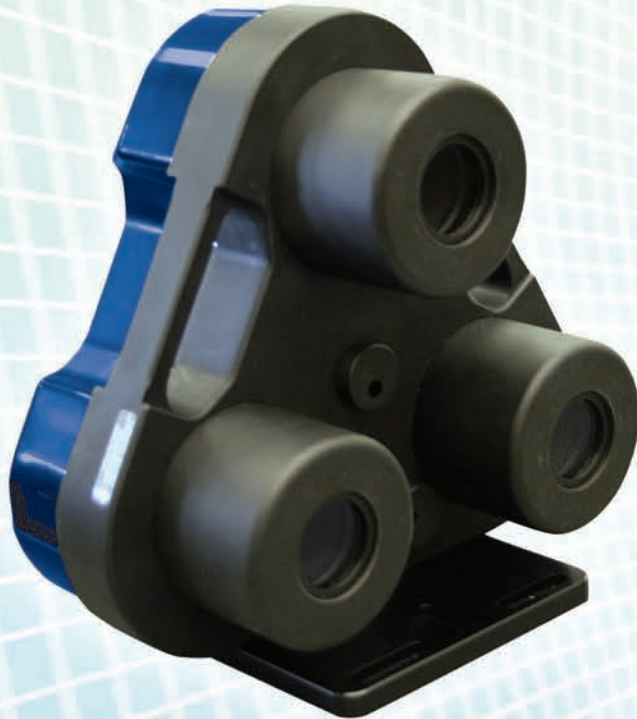
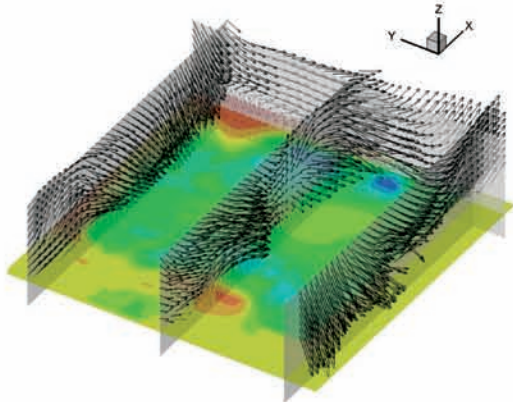
FLUID MECHANICS

V3V™ System



TRUST. SCIENCE. INNOVATION.

Introducing V3V Technology



Volumetric 3-Component Velocimetry (V3V) System

The V3V™ System brings laser diagnostic flow measurements to a whole new dimension. Never before has it been possible to measure the full 3-component velocity field within a truly volumetric region of the flow. Building upon our exclusive license to V3V technology, TSI has spent multiple person years further developing the V3V System.

3-Aperture, 12 Megapixel Camera Probe

The V3V Camera Probe captures frame straddled images of the volumetric flow region illuminated by the laser. Extending upon core TSI expertise in Particle Image Velocimetry (PIV) and Particle Tracking Velocimetry (PTV) techniques, both patented and proprietary algorithms are used to determine the velocity field based upon the displacement of tracer particles in the flow.

INSIGHT V3V Software

Built from the revolutionary Insight platform, the INSIGHT V3V software provides complete control of all steps of the measurement procedure, from image capture through processing, analysis, and 3-dimensional display.

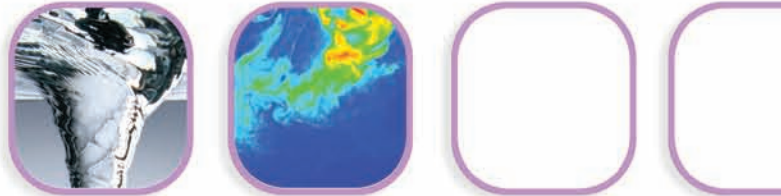
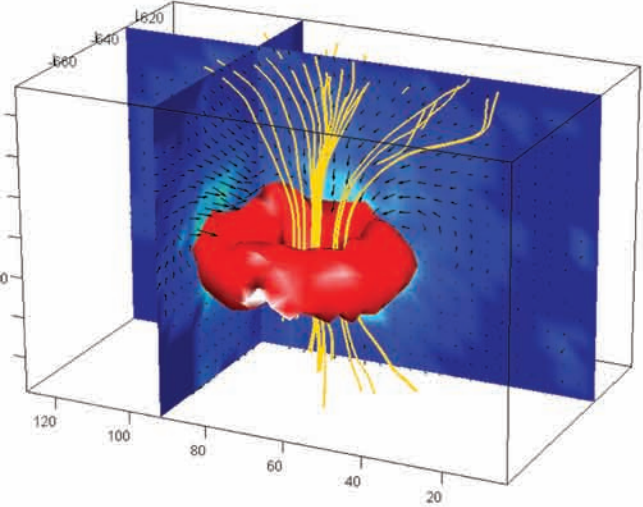
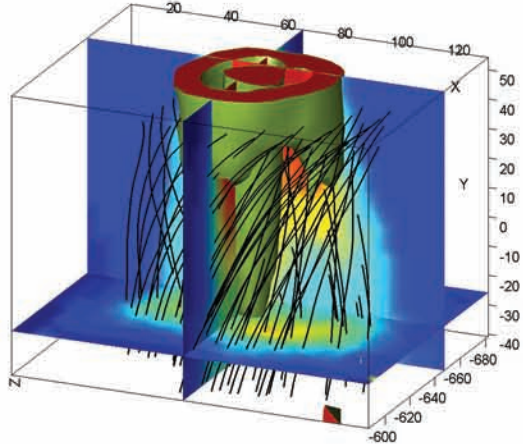
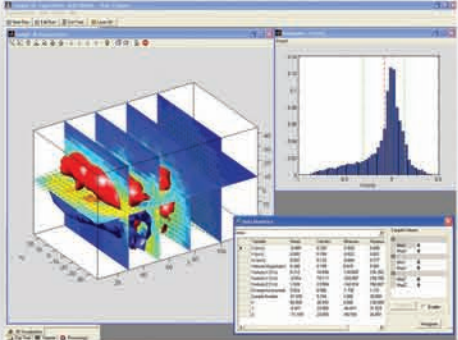
HyperStreaming Image Transfer and Computer System

The HyperStreaming computer is also featured in the V3V System allowing images to be transferred directly to the computer at the full camera frame rate, without being limited by the RAM storage capacity of the computer. This allows over 17 minutes of continuous capture at the full camera frame rate of 15 Hz.

Applications

V3V technology is used in applications with geometrically complex flows, where volumetric flow information is essential. Some common applications include:

- Flow in mixing devices
- Propellor flows
- Flow through devices
- Flow in a model heart
- Internal flows
- Wave tanks
- Sedimentation



Bringing Flow Measurements to the Next Dimension

Point and Shoot

Not only is it the most advanced flow measurement and visualization tool available, but the V3V system is also simple to use. A single, fully integrated camera system features 3-apertures with 12 megapixels. Crossing laser diodes provide rapid alignment with the measurement region, it is as simple as point and shoot, with no need for adjusting focus. All aspects of the laser and camera operation are controlled directly through the *INSIGHT V3V* system software.

Automatic Calibration

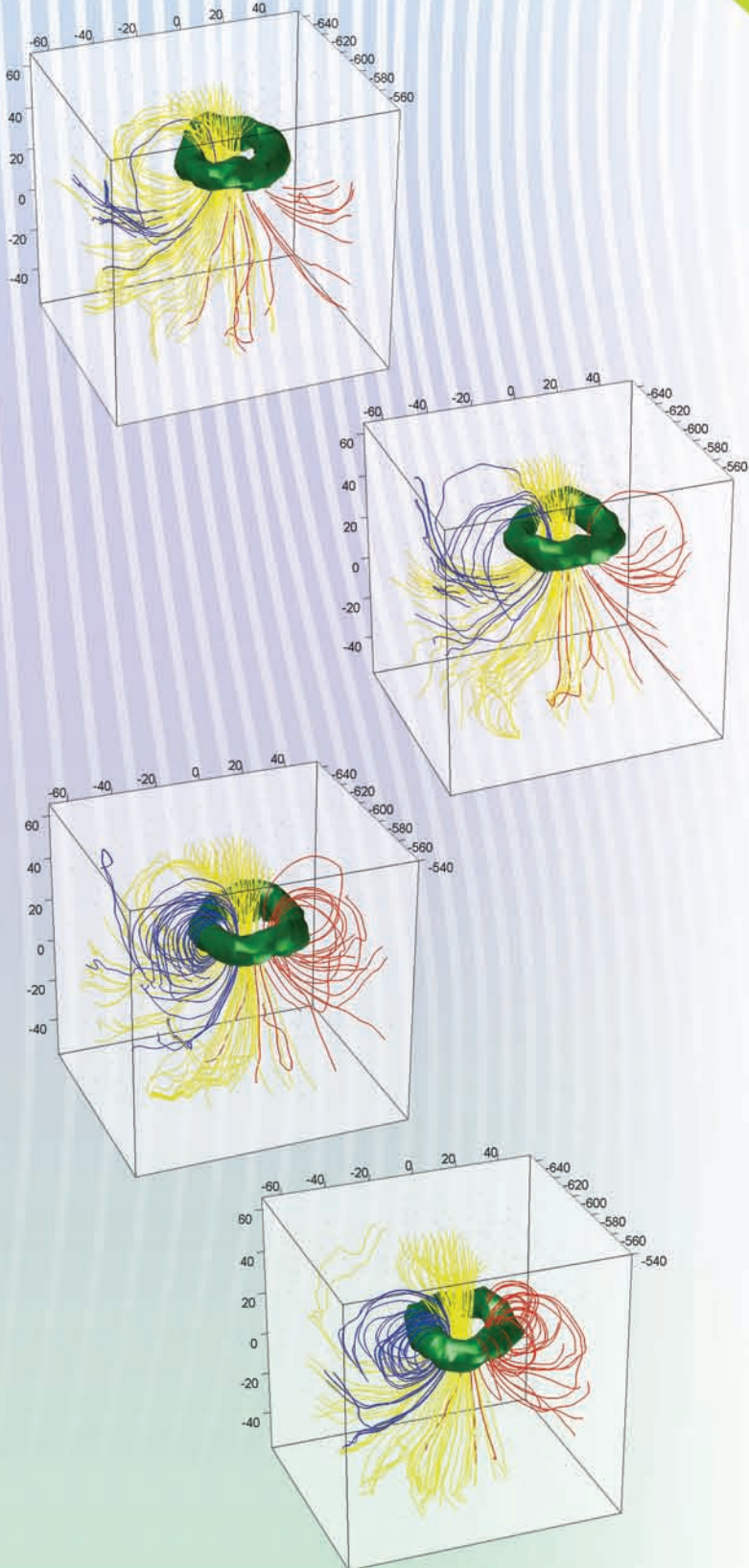
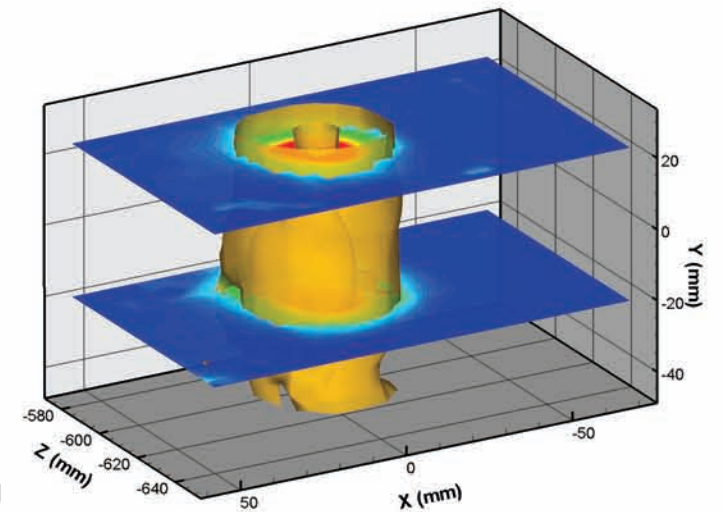
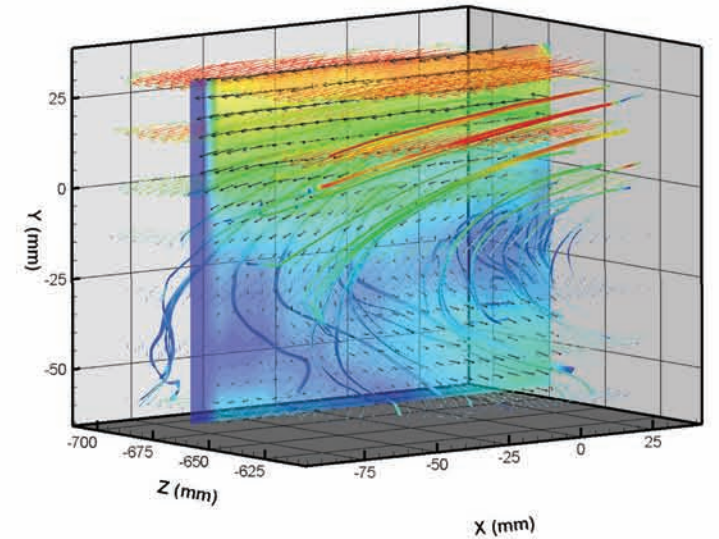
The system calibration is fully automated and driven by the *INSIGHT V3V* software. A software controlled traverse system automatically moves a calibration plate through the measurement volume. With calibration data within the entire measurement volume, the accuracy of the measured spatial location of individual tracer particles in the flow is increased. The particle location accuracy is within 20 microns in the x-y directions and within 80 microns in the z direction.

Rapid Processing

With processing times on the order of seconds, rather than minutes, as well as distributed processing across a network of computers and extended measurement times at full camera frame rate, the V3V system has the power to satisfy your measurement needs. Long data sets at full camera frame rates provide information on the temporal evolution of the flow. Combined with the complete spatial coverage provided by the volumetric nature of the flow measurements, this makes V3V technology the clear choice.

Integrated 3D Graphics and Display

The *INSIGHT V3V* package features a complete arsenal of 3-dimensional graphics and display options. From the fundamental measurement of the 3-Dimensional, 3-Component (3D3C) velocity field, other flow parameters such as vorticity and streamlines can be shown throughout the measurement volume. The velocity vector field can be displayed within the entire measurement volume, or along specific planar slices to highlight features in the flow. Iso-surface plots of the vorticity field can be superimposed or shown separately. Animations and movies can be generated at the click of a button, creating scans of the various flow properties, rotating volume plots, and temporal evolution of the flow.

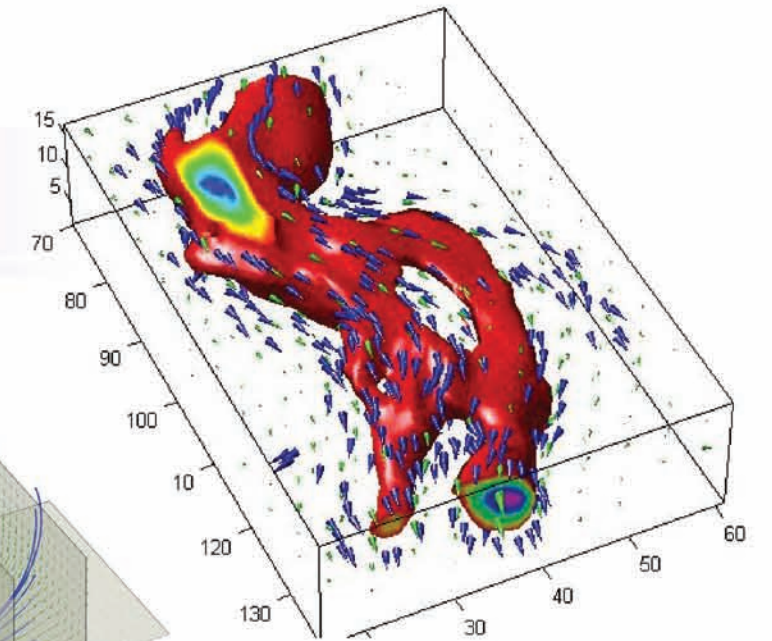
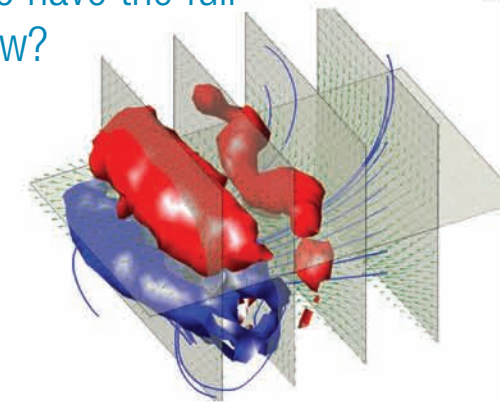
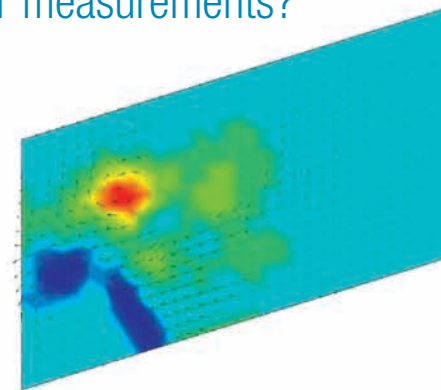
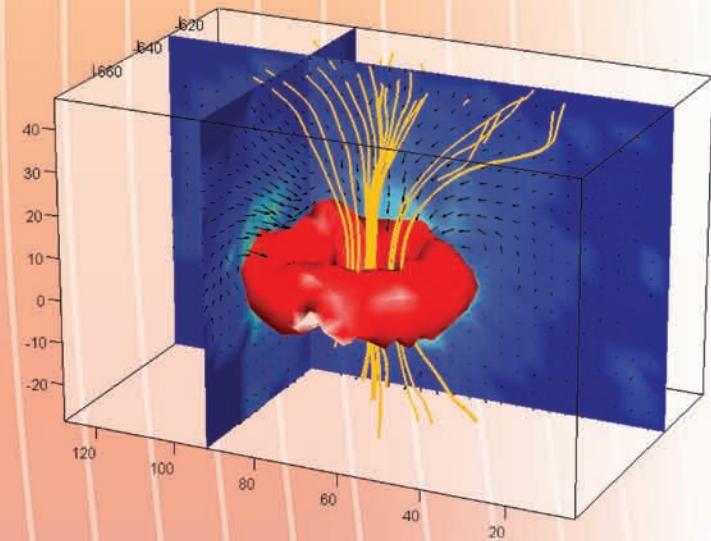


Truly New, Truly Global V3V Gives Results



Are you getting all of the results that you need from planar or quasi-planar measurements?

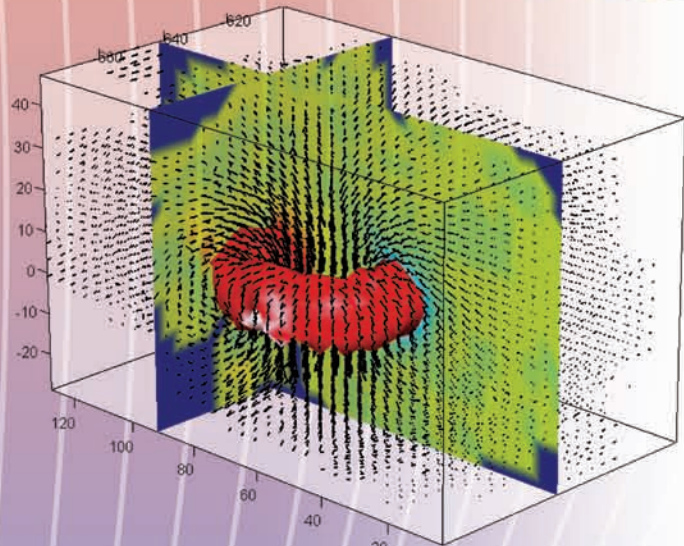
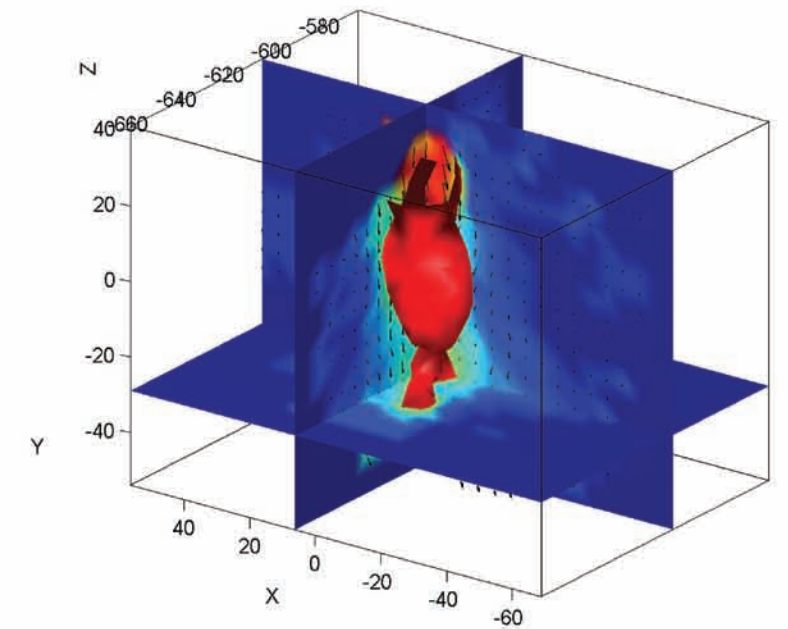
Or would it help to have the full picture of your flow?



Shown to the left are V3V measurements of the vortex ring at the outlet of a pulsed jet. The iso-surface of vorticity clearly shows the full 3-dimensional nature of the vortex ring. The top diagram shows fluid streamlines and planar slices of the velocity field. The bottom diagram shows the velocity field throughout the volume, with surface contours of the vorticity.



The above results show measurements of the flow downstream of a flapping plate; (above left) measured velocity field in a planar region of the flow with the color showing vorticity contours, as would be obtained from PIV measurements; (above right) the results from the V3V measurements, where the red and blue surfaces are iso-surface contours of vorticity. Also shown are the velocity vectors in select planar slices of the flow and the 3D streamlines (blue). The measurement volume was 80 mm x 80 mm x 100 mm.



Specifications

MODEL V3V-8000 SYSTEM SPECIFICATIONS:

Model V3V-8000 Camera Module

Max. Measurement Volume	140 mm x 140 mm x 100 mm
Particle position uncertainty	20 micron (x-y) 80 micron (z)
Minimum Stand-off	310 mm
Maximum Stand-off	670 mm
Number of imaging pixels	12 million
Pixel Size	7.4 micron x 7.4 micron
Maximum Frame Rate	15 Hz

HyperStreaming Image Transfer and Computer System

Max. Capture Time at Full	
Camera Frame Rate	17 minutes

Software

INSIGHT V3V Software Platform

Laser

Wavelength:	532 nm
Maximum Repetition Rate:	15 Hz
Laser pulse energy:	200 mJ (380 mJ optional)

TSI Incorporated serves a global market by investigating, identifying and solving measurement problems. As an industry leader in the design and production of precision instruments, TSI partners with research institutions and customers around the world to set the standard for measurements relating to aerosol science, air flow, indoor air quality, fluid dynamics and biohazard detection. With headquarters based in the U.S. and field offices throughout Europe and Asia, TSI has established a worldwide presence in the markets we serve. Every day, our dedicated employees turn research into reality.

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